his life; and even those who think it might have been better for science had their own peculiar plans been carried into effect, will hardly grudge Prof. Owen the palm of victory which he may have won from them.

The necessary and often arduous routine work required of Prof. Owen as head of so large a department did not in any great measure diminish the extraordinary activity with which he from time to time published original works. Nearly a quarter of a century has elapsed since he entered on his duty at the British Museum, and the record of his contributions to science during this period equals, if it does not surpass, that of the previous thirty years period. Among the more important of these we must notice: Memoir on the British Fossil Reptiles of the Mesozoic Formations—Pterodactyles, 1873-1877; on the British Fossil Reptiles of the Liassic Formations—Icthyosaurs and Plesiosaurs, 1865-1870; on the British Fossil Cetacea of the Red Crag, 1870; on the Fossil Reptiles of South Africa, 1876; on the Classification and Geographical Distribution of Mammals, 1859; a Manual of Palæontology, 1861. The long list of papers published in the *Proceedings* of learned societies, to be found in the Royal Society's invaluable Catalogue (numbering over 360), includes many, the scientific value of most of which would have given an abiding fame to their author. It would be impossible here to give even a tithe of their titles, but we quote a few to show that Prof. Owen left few of the classes of the animal kingdom unnoticed:—On the Andaman Islanders; on the Anthropoid Apes; on the Aye-Aye; on the Giraffe; on the Great Anteater; on the Great Auk; on the Dodo; on the *Apteryx australis;* on *Lepidosiren annectens;* on the *Argonauta argo;* on *Spirula australis;* on Clavagella; on *Limulus polyphemus;* on Entozoa; on *Euplectella cucumer* and *E. aspergillum.*

In 1857 he was elected president of the British Association for the Advancement of Science. In 1859 he was chosen one of the eight Foreign Associates of the Institute of France (in succession to Robert Brown). The King of Italy conferred on him the "Ordre de St. Maurice and St. Lazare" in 1862. The Emperor of Brazil in 1873 gave him the Imperial Order of the Rose, while in the same year the Queen conferred on him the Order of the Bath. In 1874 the Academy of Medicine, Paris, elected him as one of their Foreign Associates in succession to Baron Liebig.

At an age when most men have to cease from their labours, the subject of this necessarily brief notice works on. No better proof could there be of a spirit still young, than to witness the energy with which he has entered on the occupation of the new home for natural history at South Kensington; and who will not join in the hope that he may live to see its treasures arranged in an orderly sequence. In this sketch we have presented Prof. Owen as one eminently qualified to take high rank among our Scientific Worthies. What niche in the temple of fame he may permanently occupy is perhaps better left to a generation removed from our own to determine. To us it would seem as if a double portion of the spirit of Cuvier had without doubt fallen upon Owen, who has raised for himself a monument of work that is truly stupendous.

INSECT VARIETY

Insect Variety: its Propagation and Distribution. Treating of the Odours, Dances, Colours, and Music in all Grasshoppers, Cicadæ, and Moths; Beetles, Leaf-Insects, Bees, and Butterflies; Bugs, Flies, and Ephemeræ; and Exhibiting the Bearing of the Science of Entomology on Geology. By A. H. Swinton, Member of the Entomological Society of London. (London, Paris, and New York: Cassell, Petter, Galpin and Co. No date.)

WHEN Mr. Darwin published his "Descent of Man" in 1871 non-entomological readers were first made acquainted with a host of interesting facts connected with the various sounds produced by insects, the different colours in the two sexes, with their corresponding senses, emotions, and habits, so far as these bore upon the question of sexual selection. As in so many other cases Mr. Darwin's volume was the means of attracting the attention of working entomologists to this interesting field of observation, which has since been assiduously worked by Dr. Fritz Müller in Brazil, while in this country Mr. Swinton has for many years devoted himself to its study, both by personal observation and by collecting together the scattered observations spread over the entire literature of entomology, the result of his labours being embodied in the present volume.

No more interesting or instructive subject could be found for a great entomological work. The author appears to have spared no pains in the collection and elaboration of his materials. The book is full of original observations, and carefully drawn tabular statements of facts. It is copiously illustrated with roughly executed but characteristic figures; and the writer is evidently a man of wide information and some literary skill. But notwithstanding all these points in its favour, the book—except as a mere collection of facts—is a disappointing one. The arrangement is frequently defective; the style is often so vague and high-flown as to be actually unintelligible; while whenever an attempt is made to generalise the facts adduced, the writer appears to have no definite views of his own, or if he has is quite unable to convey them to the reader. A few examples will serve to illustrate the several merits and defects here pointed out.

In discussing the combats of male insects as tending towards a selection of powerful males from which to continue the race, our author well remarks that the law of the prior appearance of the males subjects them also to all atmospheric and other influences, "rendering them inured to manifold terrestrial strife previous to propagating their kind." This is a good observation; but what is probably a more important function of the early appearance of the males is, that the females should not have to wait long in order to be impregnated and thus be exposed to the dangers of destruction, owing to their usually slower flight and consequent defencelessness, before their great duty of oviposition has been safely performed.

The remarkable discovery by Dr. Fritz Müller of scent-producing organs in a variety of Brazilian butterflies, is here supplemented by an account of the numerous cases in which analogous organs, often of very varied kinds, have been found in moths, though in comparatively few instances has any odour been actually detected. It may however very possibly exist even though quite imperceptible to us. Most of these organs occur in male insects only, whereas it is undoubtedly the case that the males discover the females at great distances, and we should therefore anticipate that the latter would have the scent-producing organs, the former the sense-organ capable of perceiving the odour. The investigation of this obscure subject is however still in its infancy.

Whether the antennæ are organs of touch only or of some other sense is yet undecided, but the question might probably be solved by an experimenter as ingenious and persevering as Sir John Lubbock. Mr. Swinton speaks of the male butterfly or moth "running over his partner with snuffing antennæ," but this is begging the question; and the following observation, though interesting, does not throw much additional light on the subject: "One dull afternoon on the 4th of September during the wet season of 1879 my eye was arrested by the pretty dappled wings of a female of the large Magpie Moth who was flying most purposely from leaf to leaf along a hedgerow. She successively visited a reddening bramble, a hawthorn, clematis, and guelder-rose, fruitlessly touching over their glandular surfaces with a quick alternate vibration of her black antennæ, in search, as I at first supposed, of honey-dew. The crisping foliage of a thorny sloe finally arrested her, and seemed to confer satisfaction on her tactile perception; for raising simultaneously her feelers and crawling on to the centre of a leaf, she hung on at its upper surface, elevated her wings, and by curling her abdomen round its apex, began to methodically attach her oval and shagreened eggs to the underside close to the midrib. She could distinguish Souchong from Pekoe."

The account of light-giving insects is very unsatisfactory, the old theory of the light serving as a guide and attraction to the male being the only one given. Yet in the list of luminous insects appended to the chapter we find no less than six cases recorded in which larvæ or pupæ are luminous, a fact which might surely have suggested a doubt as to the use of luminosity as a sexual attraction in the case of the glowworm and fireflies. There being so many luminous larvæ, taken in connection with the fact (not mentioned by Mr. Swinton) that glow-worms are distasteful to birds, renders it almost certain that Mr. Belt's explanation is the true one, and that luminosity is, primarily, a warning of uneatableness, and is therefore a protective character, though it may of course, like colours, serve the purpose of aiding discovery and recognition by the opposite sex.

The whole subject of colour is treated with vagueness and indecision, and we find no systematic grouping of the facts nor any firm grasp of a principle by which to interpret them. The following characteristic passage will illustrate these deficiencies:—"The attractive quality of insects' colours from the foregoing appears nearly that presented to the human eye, and, utilised in sedentary or aërial display, originates phenomena of love and rivalry, battles, dances, and gregariousness in evident parallelism with those evoked by music. But this attractive virtue, which must be considered as stimulative, does not reside especially in either sex, as some at first sight might be inclined to assert; for we find conspicuous colorisation, though for the most part distinguishing the males, sometimes by a species of inversion appearing in the females; the sexes also are often very similar in hue. And the reason of this is that the females very generally attract the eager males by sedentary display, of which the moth kind affords notable instance. Here we may remark the paler hues of many heavy Bombycina females who exhibit on herbage, and the grey, white, or satiny shades of moths that repose on tree-trunks, sexually marked in the Gipsy Moth, who is rendered in measure terrestrial by her limp wings. Others more or less apterous, like the Vapourers and Psychidæ, owe what little chromatic attraction they possess to their conspicuous cocoons."

There is hardly a sentence in this paragraph that is not open to discussion or that is not more or less inconsistent with some other sentence; while the whole is completely neutralised by the succeeding paragraph which goes on to describe how the male moths are evidently attracted to their partners by odour, and not by sight at all!

The chapter on the sounds produced by insects is crowded with interesting observations and is certainly of great value, yet here too we meet with the same looseness of remark and incapacity to see the importance of certain facts. Thus, we find the strange, and in the present state of our knowledge altogether unproved statement, that—"In Lepidoptera music is in direct relation to colour, sound to beauty;" while the fact that the *pupal* form of some Hemiptera stridulate, taken in connection with many proofs that the sound is produced under the influence of *fear*, shows that in some cases at all events these sounds are protective rather than sexual; and this opens up a field of inquiry analogous to that of the diverse uses of colour, but which our author passes over almost without remark.

Among the smaller errors and misconceptions in the volume we must note the statement that Darwin adopts the pressure theory of the formation of the bee's cell (p. 58); the total misconception of the theory of mimicry (at p. 81); and the extraordinary account of tropical colour, certainly evolved out of the writer's own consciousness. He says:—"In the Brazils, for example, all colours, whether of birds, insects, or flowers, are brilliant in the extreme. Blue, violet, orange, scarlet, and yellow are found in the richest profusion, and no pale faint tints are to be seen"! In the matters of Palæontology and glacial epochs the author's authority is Mr. Page; but the subject is evidently beyond him, for he confounds the precession of the equinoxes with the obliquity of the ecliptic, and winds up with "glacial phenomena at the poles now exposed to the continuous action of cold interstellar space, with a collapsing in the earth's superficies, giving birth to the ensuing wrinkling marked by earthquakes, volcanic action, and land depression, or *vice versâ*."

We also notice many errata, indicating some carelessness in passing the volume through the press. Dr. Falconer is called "Faulkener" (p. 15); anthropods is written for arthropods (p. 86); Leucanidæ for Lucanidæ (p. 99); Grophilus for Geophilus (p. 101); and Libuella for Libellula (p. 311); but the chief fault of the volume is a constant effort at fine writing, which, combined with an inveterate obscurity of style, often renders it utterly impossible to comprehend what is meant. Scores of passages might be quoted illustrative of this peculiarity, but the following will serve our purpose:—

"Dealing with geological chronology, the phenomena of generic and specific variation should also be applicable in explanation of certain plants and insects of constant character, being discovered confined to various geological soils within the radius of their distribution, or to favourite haunts postulating more than simple dispersion from a centre. And the pale blue of butterflies frequenting limestone and chalky downs need evoke no interference in the law of albinism if the honeyed cowslips and downy oxlips over whose leaves they flutter are, as reputed by Linnæus and Prof. Henslow, specifically identical with the shadow-seeking primrose, and may be raised from the same root. So likewise the local feature of melanism may be regarded as not only manufacturing annual varieties, but as pervading the black, brown, and drab tribes of the Alpine, Arctic, and woodland faunas, and may give a reason for their dark trait of beauty."

We give up the above in despair of extracting its meaning, if it has any; and cannot but regret that a book so full of valuable facts and good observations should be spoilt by constant efforts at philosophical disquisition, for which the tone of mind of the writer quits unfits him.

WEAPONS AND POLITICS OF THE ANCIENT HINDUS

On the Weapons, Army Organisation and Political Maxims of the Ancient Hindus, with Special Reference to Gunpowder and Firearms. By Gustav Oppert. (Madras: Higginbotham and Co.; London: Trübner and Co., 1880.)

"WHILE pursuing my researches into ancient Indian history," says Dr. Oppert, "I lighted upon two ancient Sanskrit manuscripts containing interesting information on many new and important topics. One of them, the Nītiprakā'sikā, has been, I believe, up to now utterly unknown, and the other, the 'Sukranīti, though known to exist, has never been described and published." The manuscripts relate to the weapons and military organisation of ancient India, a subject upon which fresh light was much needed If for no other reason, therefore, they deserved to be edited and translated. But one of them at least also contains statements sufficiently novel and startling to claim for them a special hearing. If we may believe it, not only was gunpowder invented in India long before the days of Berthold Schwarz or Roger Bacon, but firearms, including both cannon and guns, were known and used. The guns were even provided with sights and flints. "The tube" of one of them, it is said in the Sukranīti, "is five spans long, its breech has a perpendicular and horizontal hole, at the breech and muzzle is always fixed a sesame-bead for aligning the sights. The breech has at the vent a mechanism which, carrying stone and powder, makes fire by striking. Its breech is well-wooded at the side, in the middle is a hole, an *angula* broad; after the gunpowder is placed inside, it is firmly pressed down with a ramrod. This is the small gun which ought to be carried by foot-soldiers. . . A big gun is called (that gun) which obtains the direction of the aim by moving the breech with a wedge; its end is without wood; but it is to be drawn on cars. . . . The ball is made of iron, and has either small balls in its inside or is empty." Dr. Oppert believes that the Nītiprakā'sikā also contains references to firearms, though the passages he quotes seem rather to refer to supernatural weapons or to fire-machines like those used by the Greeks of the Eastern Empire. A work, too, which mentions the Hunas ("Huns," or Europeans) cannot be of the antiquity to which he would assign it.

Dr. Oppert seeks further support for the early use of firearms in India in a passage from a portion of the Atharvanarahasya, which he renders: "the fire prepared by the combination of charcoal, sulphur, and other material depends upon the skill of its maker." It is plain, however, that there is no necessary allusion to gunpowder in these words, much less to firearms. A quotation from Manu, in which fighting with "darts kindled by fire" is forbidden, is equally inconclusive.

The statements of the 'Sukranīti must therefore stand by themselves. In spite of Dr. Oppert's arguments to the contrary, it is difficult to admit that in its present form it can be earlier than the thirteenth century. The prohibition to use firearms in "fair" fighting would not account for the total absence of any reference to them in the law-books and epics and other literature of ancient India, and had they existed in the seventh century, or had the Hindus been acquainted with gunpowder at that time, we can hardly suppose that the fact would have remained unknown to the inquisitive Buddhist pilgrims from China who have left us accounts of their travels in the Peninsula. The Greek fire had nothing to do with gunpowder, and we do not therefore see why Dr. Oppert introduces it into the discussion, while there is no proof that the *manjanīk* or machine employed by Mohammed Kasim at the siege of Daibal (A.D. 711) was propelled by gunpowder. The flaming thunderbolts launched by the Indians against the army of Alexander, according to the pseudo-Aristotle, belong to the region of myth, like the storms of lightning with which Herakles and Dionysos were received when they invaded India, as related in the romance of Philostratos. Gunpowder may indeed have been invented in India, as Beckmann believed, but if so we want further evidence before we can admit that the invention was earlier than the twelfth or thirteenth century of our era.

Among other interesting points noticed by Dr. Oppert are the (ideal) rate of pay received by the officers and privates of a Hindu army at the time the Nītipraka sika was composed, and the identification of Manipura, the capital of the Pandya kings, with the modern Madura. He also points out that the boomerang is well known in many parts of India, especially in the south, and that he himself possesses four wooden ones, besides an iron one, which he obtained from Pudukoṭa. Two ivory ones, from the armoury of the late Rajah of Tanjore, are preserved in the Madras Museum. The Tamil name of the boomerang is *valai tadai*, or "bent stick," and it is employed in hunting deer. It is one of the weapons described in the Nītipraka sika under the name of *astara* or "scatterer."

OUR BOOK SHELF

Lehrbuch der organischen Qualitativen Analyse. Von Dr. Chr. Th. Barfoed. (Kopenhagen: Andr. Frest und Sohn, 1880.)

THERE is no branch of qualitative chemical analysis in such an unsatisfactory condition as that which deals with organic acids and bases. The plans on which examina-